

Mammalia, Chiroptera, Rio Grande, state of Rio Grande do Sul, Brazil

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ABSTRACT: Herein we present a checklist of the bat species recorded in the municipality of Rio Grande, coastal plain of Rio Grande do Sul state. Thirteen species of three families were recorded through field sampling, collection specimen analysis and bibliography compilation. Molossidae and Vespertilionidae, both with five recorded species, were the most representative families, while three species of Phyllostomidae were recorded. Seven species were found in urban areas. In the sampled natural environments, six species were found in riparian systems, being *Myotis albescens* and *Molossus* sp. recorded only in these formations. Riparian systems, hence, can represent relevant habitats for chiropteran conservation in coastal areas of southernmost Brazil.

INTRODUCTION

Chiroptera is the second largest mammalian order, with around 1,120 described species (Simmons 2005), which comprises around 22% of all the living mammals (Wilson and Reeder 2005). In Brazil, 172 bat species have been recorded (Reis *et al.* 2011), of which 38 occurring in the southernmost state of Rio Grande do Sul (Pacheco *et al.* 2007).

Most of the data concerning bat species records and habitat occupancy in Rio Grande do Sul are restricted to northern and central regions of the state (*e.g.* Santos 1978; Wallauer and Albuquerque 1986; Rui and Fabián 1997; Grillo *et al.* 2003; Witt *et al.* 2003; Bernardi *et al.* 2007; 2009; Weber *et al.* 2006; 2007; Santos *et al.* 2008; Pacheco *et al.* 2008). In the southern portion of the geomorphological unit of coastal plain, considered as part of an area of extreme biological importance for mammal conservation in Atlantic Forest and *Campos Sulinos* biomes (Conservation International do Brasil *et al.* 2000), little effort has been made for the understanding of the richness and ecological features of mammalian fauna assemblages. Published data on chiropteran occurrence in this important area have been restricted to punctual records of *Desmodus rotundus* (É. Geoffroy, 1818) (Fabián *et al.* 1999), *Nyctinomops laticaudatus* (É. Geoffroy, 1805) (Pacheco and Freitas 2003) and *Myotis albescens* (É. Geoffroy, 1806) (Quintela *et al.* 2008). Aiming to contribute to information gathering about the chiropteran fauna in this region, we present a list of bat species recorded in the municipality of Rio Grande, southern Rio Grande do Sul coastal plain, besides data on habitat occupancy.

MATERIALS AND METHODS

The municipality of Rio Grande (31°47'02" – 32°39'45" S, 52°03'50" – 52°41'50" W) is located in Coastal Plain of Rio Grande do Sul state, southern Brazil (Figure 1). The climate in the city is classified as humid sub-temperate, with average annual temperature of 18.1°C, total annual precipitation of 1,162mm (Maluf 2000) and rainiest period from July to September (Vieira 1983). The altitude varies from sea level to seven meters (Vieira 1983). The municipality is inserted in *Campos Sulinos* biome (IBGE 2004).

Species were recorded through captures in mist nests and diurnal shelters, analysis of specimens stored in collections and bibliography compilation. Field sampling were conducted in seven areas, being them: (1) human habitations and warehouses in rural locality of Domingos Petrolini (31°59' S, 52°18' W); (2) stream with herbaceous/shrub riparian vegetation and salt marshes in the rural locality of Arraial (31°59' S, 52°14' W); (3) shrub grasslands, shrub dune formations and human habitations in rural locality of Marinheiros estuarine island (32°00' S; W 52°06' W); (4) public squares and buildings in downtown area (32°02' S, 52°05' W); (5) shrub grasslands, anthropogenic shallow lakes and buildings in urban locality of *campus* Carreiros of Universidade Federal do Rio Grande (FURG) (32°04' S, 52°10' W); (6) coastal stream, marshes, *restinga* peat wood and sandy riparian *restinga* wood in the Área de Proteção Ambiental da Lagoa Verde (APA Lagoa Verde) (32°09' S; 52°11' W); (7) human habitations in urban area of Cassino (32°11' S, 52°09' W).

In October 1998 and from May 2005 to February 2010

we performed 26 sampling nights utilizing three mist nets (9 x 3m) per night. Mist nets were installed at the height of 0.5 m inside and at the border of forest fragments, above and adjacent to water bodies and around built areas (bridges and buildings), comprising a total effort of 219,024 m²/h (Straube and Bianconi 2002). In sampling areas we also verified diurnal shelters (tree hollows, roofs, attics, dilatation gaps) in which presence of bats was previously identified by the authors, collaborator researchers and locals. Individuals found in shelters were captured by hand and hand nets. We also analyzed specimens from the didactic collection of the Zoology Laboratory – Institute of Biological Sciences (ICB)-FURG, collected from human habitations in Cassino on an unknown date in 1998.

Voucher specimens were deposited in the Museu de Ciência e Tecnologia da Pontifícia, Universidade Católica do Rio Grande do Sul (MCT), Museu de Ciências Naturais, Universidade Luterana do Brasil (MCNU) and Instituto Sauber (CIS). Collection was authorized by Chico Mendes Institute (ICMBio: process no. 325-1). Individuals were identified according to La Val (1973), Vizotto and Taddei (1973), Gregorin and Taddei (2002) and Barquez and Díaz (2009). Nomenclature follows Reis *et al.* (2011).

RESULTS AND DISCUSSION

We analyzed 110 specimens, 99 from field sampling and 11 from the zoological collection of ICB-FURG. These specimens are distributed in three families, 11 genera and 13 species (Table 1), which represent 34.2% of the chiropteran richness known so far in Rio Grande do Sul state (Pacheco *et al.* 2007). Individuals of 12 species were collected in field sampling. Four species were identified in the zoological collection of ICB-FURG (Table 1). The occurrence of *Nyctinomops laticaudatus* in the municipality (Taim Ecological Station) was determined only from literature review (Pacheco and Freitas 2003).

Five species of Molossidae were recorded. All specimens of *Tadarida brasiliensis* (L. Geoffroy, 1824) and the single specimen of *Promops nasutus* (Spix, 1823) were sampled in shelters in urban areas, which comprised asbestos and ceramic attics. *Molossus molossus* (Pallas, 1766) specimens were captured in mist nets over coastal stream with riparian wood and building dilatation gaps. Three specimens were also found dead in downtown sidewalks after storms. A single specimen of the genus *Molossus* É. Geoffroy, 1805, which may represent a taxon still not formally described (herein assigned as *Molossus*

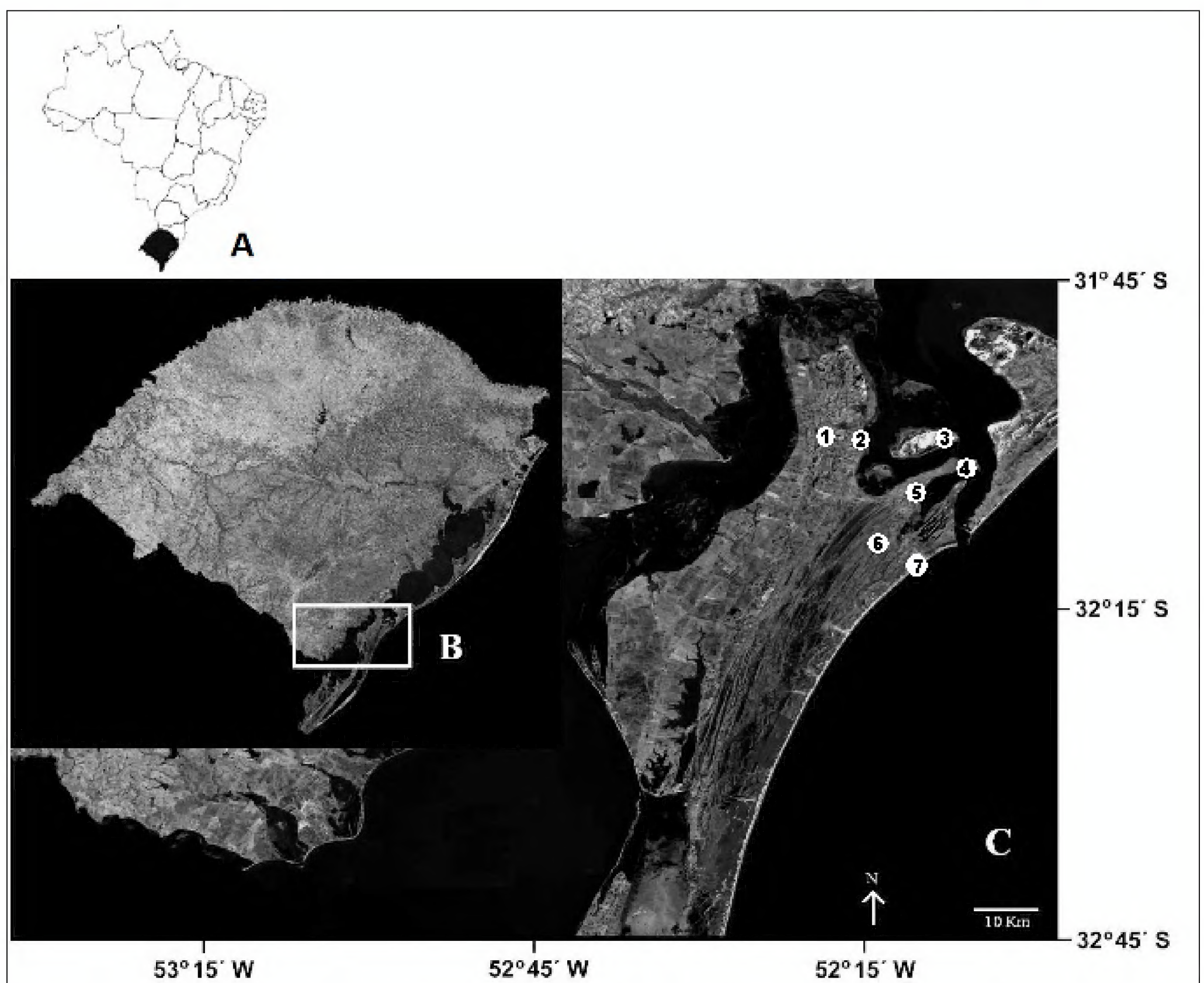


FIGURE 1. Location of Rio Grande do Sul state in Brazil (A), part of coastal plain (B) and sampled localities in the municipality of Rio Grande (C): Domingos Petrolini (1), Arraial (2), Marinheiros Island (3), downtown area (4), Campus Carreiros of Universidade Federal do Rio Grande (FURG) (5), Lagoa Verde Environmental Protection Area (6), Cassino (7).

sp.), was captured in mist nets over coastal stream with riparian wood.

Five species of Vespertilionidae were registered. *Histiotus velatus* (I. Geoffroy, 1824) individuals were captured in mist nets over stream with riparian wood. A colony was found inhabiting the gaps of a ceramic roof in a warehouse located in the middle of herbaceous grassland. A single individual of *Eptesicus brasiliensis* (Desmarest, 1819) was captured in mist net over sandy riparian wood, while another one was found dead in an attic with ceramic roof in urban area. A single individual of *Myotis albescens* was captured in mist net over coastal stream with shrub/herbaceous riparian vegetation, which was previously reported in a preliminary phase of this study (Quintela *et al.* 2008). Two specimens of *Myotis nigricans* (Schinz, 1821) were found dead in a bridge over a coastal stream with sandy riparian wood, while another specimen was captured in mist net in a marsh area. An individual of *Lasiurus blossevillii* (Lesson & Garnot, 1826) was captured in a shrub dune formation in the Marinheiros estuarine island.

Three species of the Phyllostomidae were recorded. Specimens of *Glossophaga soricina* (Pallas, 1766) were captured in attics with ceramic roof and mist nets installed around it, in shrub grasslands of rural areas. A single specimen was found in ceramic roof in urban area. A single specimen of *Sturnira lilium* (É. Geoffroy, 1810) was captured in mist net in a public square in urban area. A single specimen of *Desmodus rotundus* was captured in a stable in herbaceous grassland of rural area.

The higher richness of Molossidae in relation to other families in the present study did not corroborate with the great majority of previous surveys in urban and natural environments of Brazilian biomes, where a clear dominance of Phyllostomidae species is observed (*e.g.* Reis *et al.* 2000; Baptista and Mello 2001; Dias *et al.* 2002; De Knecht *et al.* 2005; Barros *et al.* 2006; Bordignon 2006; Arnone and Passos 2007; Andrade *et al.* 2008; Gregorin *et al.* 2008; Carvalho *et al.* 2009). Beside Molossidae, Vespertilionidae representativeness in the studied area is also contrasting with the previous studies aforementioned. However, Vespertilionidae was the richest family in the municipality of Frederico Westphalen, northernmost Rio Grande do Sul (Bernardi *et al.* 2009). In a broader geographical scale, Vespertilionidae is also the most representative family in Rio Grande do Sul (Pacheco *et al.* 2007) and Uruguay (Achaval *et al.* 2007), which suggests a differentiation in bat species composition in these subtropical domains when compared to Phyllostomidae predominance in more setentrional physiognomies such as Atlantic Forest (Emmons and Feer 1997; Marinho-Filho 1996a) and Cerrado (Marinho-Filho 1996b). Willig and Selcer (1989) state that there is a decrease in Phyllostomidae richness and an increase in Vespertilionidae and Molossidae richness within the higher latitudes. Furthermore, we also observe a severe differentiation in trophic guild richness dominance patterns, with a clear reduction of frugivorous in Campos Sulinos when compared to Atlantic Forest and Cerrado. In Campos Sulinos, climate features and reduction of arboreal vegetation, including fruiting trees, may represent a limiting factor for frugivorous phyllostomids richness, which resulted in the pattern of dominance of

insectivorous guild of vespertilionids and molossids.

All of the species recorded in the present study were cited by Pacheco *et al.* (2007) as occurring in Piratini-Mirim-São Gonçalo hydrographic basin, which comprises Rio Grande and other 21 municipalities in southern Rio Grande do Sul. Moreover, Pacheco *et al.* (2007) pointed out the occurrence of other five species (*Eptesicus diminutus* Osgood, 1915, *Histiotus montanus* (Philippi & Landbeck, 1861), *Lasiurus cinereus* (Palisot de Beauvois, 1796), *Lasiurus ega* (Gervais, 1855) and *Myotis levis* (I. Geoffroy, 1824)) in Piratini-Mirim-São Gonçalo basin, while Vieira (1955) cited the occurrence of *Chrotopterus auritus* (Peters, 1856) and *Myotis ruber* (É Geoffroy, 1806) in the county of São Lourenço do Sul, which presents a similar vegetal physiognomy to that of Rio Grande and is located about 100 km away. Considering the large area and the habitat heterogeneity of Rio Grande, it is possible that additional sampling effort may increase the species list herein presented.

Four vespertilionids (*E. brasiliensis*, *H. velatus*, *M. albescens* and *M. nigricans*) and two molossids (*Molossus* sp. and *M. molossus*), which correspond to 46% of the richness found in the studied area, were recorded in riparian formations. These were also the only environments where *M. albescens* and *Molossus* sp. were recorded. *Myotis albescens* is considered as Data Deficient for conservation status evaluation in Rio Grande do Sul (Pacheco and Freitas 2003), while *Molossus* sp. may represent a species not yet described. In this regard, riparian systems may play an important role in maintenance of chiropteran diversity in the region, hosting populations of species which are naturally rare or not tolerant to high anthropic disturbance. Pacheco and Marques (2006) also emphasize the importance of riparian forests for bat conservation.

Sturnira lilium, *P. nasutus* and *T. brasiliensis* lack data on natural habitat occupancy in Rio Grande, once all the captures of these species occurred in urban areas of the municipality. Captures of *M. molossus* and *E. brasiliensis* and the presence of *G. soricina*, *H. velatus* and *M. molossus* in the ICB-FURG collection also indicate the occurrence of these species in urban areas. All of these species and *N. laticaudatus* are cited as occurring in urban areas (Santos 1978; Bredt 1998; Silva 1994; Weber *et al.* 2007; Zortéa 2007; Pacheco *et al.* 2010). Avila-Flores *et al.* (2002) also pointed out that *N. laticaudatus* commonly roosts in hollows and crevices in modern man-made structures. In this case, *N. laticaudatus* can also occur in highly disturbed areas of Rio Grande. In relation to *S. lilium*, Gannon *et al.* (1989) cite the occurrence of the species mainly in forested habitats, while identified diurnal roosts include hollow trees (Gannon *et al.* 1989; Fenton *et al.* 2000), vine tangles and bases of palm fronds (Fenton *et al.* 2000). Considering these aspects, it is supposed that *S. lilium* may occur in *restinga* forest formations of the municipality.

In this study we present the first assessment of species richness and habitat occupancy by bats in Rio Grande, a municipality inserted in an area with recognized importance for mammalian conservation. The application of appropriate methods can therefore reveal relevant data on species abundance and ecology in the diversity of habitats of this coastal area.

TABLE 1. Families and species of bats recorded in the municipality of Rio Grande, Rio Grande do Sul State, being: a = field sampling, b = IB-FURG collection, c = previous records (Fabian *et al.* 1999; Pacheco and Freitas 2003; Quintela *et al.* 2008); MN = number of specimens captured in mist nets, DR = number of specimens captured in diurnal roosts, DS = number of dead specimens found in habitats, IB = number of individuals stored in IB-FURG collection; Hg = herbaceous grassland, Rw = stream with sandy riparian wood, Rh = stream with herbaceous/arbustive riparian vegetation, Sd = shrub dune, Sg = shrub grassland, Sw = swamp, Ua = urban area, ? = no data available.

TAXON	RECORD	MN	DR	DS	IB	HABITAT
Phyllostomidae						
<i>Desmodus rotundus</i> (É. Geoffroy, 1818)	a,c	1				Hg
<i>Glossophaga soricina</i> (Pallas, 1766)	a,b	8	17		1	Sg, Ua
<i>Sturnira lilium</i> (É. Geoffroy, 1810)	A	1				Ua
Molossidae						
<i>Molossus molossus</i> (Pallas, 1766)	a,b	11		3	2	Rw, Ua
<i>Molossus</i> sp.	A	1				Rw
<i>Nyctinomops laticaudatus</i> (É. Geoffroy, 1805)	C					?
<i>Promops nasutus</i> (Spix, 1823)	A		1			Ua
<i>Tadarida brasiliensis</i> (L. Geoffroy, 1824)	a,b		40		7	Ua
Vespertilionidae						
<i>Eptesicus brasiliensis</i> (Desmarest, 1819)	A	1				Rw, Ua
<i>Histiotus velatus</i> (L. Geoffroy, 1824)	a,b	7	2		1	Rw, Ua
<i>Lasiurus blossevillei</i> (Lesson & Garnot, 1826)	A	1				Sd
<i>Myotis albescens</i> (É. Geoffroy, 1806)	A	1				Rh
<i>Myotis nigricans</i> (Schinz, 1821)	A	1		2		Rw, Sw

ACKNOWLEDGMENTS: We are grateful to Eduardo Martins da Silva, Flávio Visnardi-Filho, Rafael Martins Pinheiro, Vanice Gutierrez, Alexandro Marques Tozetti and Maurício Beux Santos for help in fieldwork, Ana Catarina de Oliveira and Cristina Loyola Zardo for lab support and Maria Eduarda Carvalho for English review.

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RECEIVED: February 2011

LAST REVISED: June 2011

ACCEPTED: June 2011

PUBLISHED ONLINE: July 2011

EDITORIAL RESPONSIBILITY: Marcelo Rodrigues Nogueira

APPENDIX 1. Voucher list.

Desmodus rotundus: (MCNU 2448); *Glossophaga soricina* (MCNU 2538-42, MCNU 2551, MCT 1720); *Sturnira lilium* (CIS 0059); *Molossus molossus* (MCNU 2523-4, MCT 1726-8); *Molossus* sp. (MCT 1725); *Tadarida brasiliensis* (MCNU 2543-46, MCNU 2549-50, MCNU 2555-58, MCT 1724); *Eptesicus brasiliensis* (MCNU 2552); *Histiotus velatus* (MCNU 2559-66, MCT 1723); *Lasiurus blossevillii* (CIS 0098); *Myotis albescens* (MCT 1721); *Myotis nigricans* (MCNU 2547).